

REMARKS

Applicants have cancelled claims 7, 9 and 10 without prejudice or disclaimer since each of these claims is directed to a non-elected invention. Accordingly, claims 1-6 and 8 are pending.

FOREIGN PRIORITY

Submitted herewith is a certified priority document of corresponding Japanese Patent Application No. 2001-206229 for the purpose of claiming foreign priority under 35 U.S.C. § 119. An indication that this document has been safely received would be appreciated.

DUTY OF DISCLOSURE

Applicants resubmit herewith the PTO-1449 form filed with the IDS on August 3, 2002, and request that the Examiner initial reference AR and return a copy of the PTO-1449 form to the undersigned to indicate that the document has been considered.

DRAWING

With respect to numbered paragraph 4 on page 2 of the Office Action, Fig. 2 is not prior art. Rather, Fig. 2 is directed to the invention, which has been developed in connection with the studying of the wiring forming method of semiconductor devices using material with low dielectric constant (hereinafter, called low-k dielectric) and copper. Accordingly, Fig. 2 is part of the invention, which includes recognition of problems in the wiring forming methods and providing solutions to these problems. Therefore, it is unnecessary to label Fig. 2 with the legend "PRIOR ART".

SPECIFICATION AND TITLE

A new Abstract and Title are provided as required.

35 U.S.C. § 112

Claims 3 and 8 have been amended to overcome the rejection under 35 USC§112, second paragraph.

35 U.S.C. § 103

Applicants request reconsideration of the rejection of claims 1 and 2 under 35 U.S.C. § 103 as being unpatentable over the admitted prior art (APA) in view of Young et al

(Young) and Zhao; and the rejection of claims 3-6 and 8 under 35 U.S.C. § 103 as being unpatentable over APA in view of Young et al and Zhao and in further view of Loewenstein.

The present invention is directed to method and apparatus capable of forming wiring, for example, of a porous low-k film and copper. Fully dry-type processes are used in the forming steps and no wet cleaning processes are included during the entire forming. The wiring of the porous low-k film and the copper layer formed by the wiring method of the present invention has high reliability and high yield.

The disclosure of USP 6,457,477 (Young et al.) relates to a method in which a porous low-k layer is subjected to Damascene processing, and specifically, there are descriptions as to bias ashing with O_2 , SiN etching (plasma etching) with C_2F_6/O_2 , and a fully dry-type cleaning process by H_2 surface processing. However, Young do not disclose trench forming as * in the present invention, for example.

2 Zhao discloses a method of forming a Damascene interconnect in the manufacture of an integrated circuit device including the removal of contaminated SiO_2 layering and Cu-CMP processing. That is, a copper layer is disclosed as being deposited by a sequence of physical vapor deposition

(PVD), electroplating, and chemical mechanical polishing (CMP).

An objective of the present invention is to prevent the porous low-k layer from absorbing chemical solution at the time of wet processing. Even if the disclosures of Young et al. and Zhao are combined, the fully dry-type processing including a trench process is not suggested by the combination.

The disclosure of USP 5,741,396 (Loewenstein) relates to SIN layer processing using NF_3 , and it discloses that O_2 and Cl_2 are added to NF_3 . However, there is no consideration as to degradation of a Cu surface or a porous layer. Accordingly, the combination of the APA in view of Young et al and Zhao and in further view of Loewenstein does not render the invention of claims 3-6 and 8 unpatentable under 35 U.S.C. § 103.

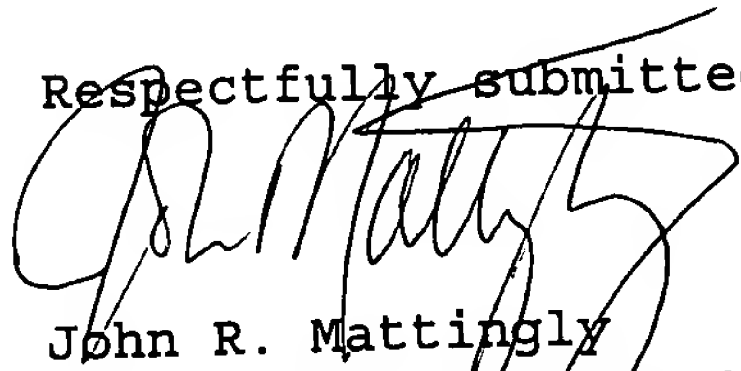
The present invention solves a problem regarding degradation of a Cu surface or a porous layer, by using a process of Ar dilution, without adding a halogen such as Cl. This method has no process for directly contacting the porous low-k film with the cleaning chemicals. Thus, the problem of chemicals being trapped in the porous low-k film can be overcome.

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In view of the foregoing amendments and remarks,
reconsideration and reexamination are respectfully requested.

Respectfully submitted,



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